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NAVAL WAR COLLEGE
Newport, R.I.

AIR POWER AND THE CENTER OF GRAVITY

by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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INTRODUCTION

Since the early days of powered flight, many air enthusiasts have claimed that "Air Power" can be decisive in wartime. From Giulio Douhet to Billy Mitchell to John Warden, all have asserted that to command the air means victory and to be beaten in the air means defeat.¹ Basic Air Force Doctrine states that "Aerospace power can apply force against any facet of enemy power. Aerospace power can be brought to bear on an enemy's political, military, economic, and social structures simultaneously or separately. It can be employed in support of national, theater/joint, or other component objectives. It can be coordinated with surface power or employed independently."² But how can that air power be used decisively and at what facet of enemy power should it be directed? Clausewitz talks of a Center of Gravity which is "the hub of all power and movement, on which everything depends. That is the point against which all our energies should be directed."³ It follows then that air power should be directed against the enemy's center of gravity whenever and wherever possible. The problem then comes to identifying the enemy's center of gravity correctly and applying the most decisive and efficient force against it. Since Air Force doctrine asserts that it can attack all facets of enemy power, then within those facets lies the center of gravity and air power can attack it. Air power's unique characteristics of speed, range, flexibility, and accessibility may make it the asset of choice by the theater commander in attacking the center of gravity first or exclusively. Air Force doctrine further states that "airmen are not constrained to achieving tactical objectives as a prerequisite to obtaining strategic objectives."⁴ When the nation's strategic or

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operational objective is to take out the enemy's center of gravity, air power can be used in one of two methods. First, air power may have the ability to hit the center of gravity out right: if so, do so. Second, if air power cannot access the center of gravity directly, it can be used to attack the enemy's critical vulnerabilities on the periphery to weaken or expose the center of gravity for further attack. In either case, the commander must determine the center of gravity correctly, plan accordingly, and plan sequentially.

This paper will study the identification of the enemy center of gravity and discuss air power's role in its destruction. To accomplish this we will look at factors used to identify the overall enemy center of gravity, then offer some possible centers of gravity both generically and historically. Following this, the paper touch on air power's ability to attack the center of gravity or attack its critical vulnerabilities. Finally I will offer some planning factors, at the operational level, for uses of air power and air force missions to support the CINC's objectives.

STRATEGIC CENTER OF GRAVITY

Before the CINC's staff can plan for air power against the enemy center of gravity, it must first be identified. There is no clear cut formula to use, and the center of gravity may be different in different wars and may also change with time in the same war. There are however some guidelines to use. FM 100-5 (and Joint Pub 1-02) defines the center of gravity as the "hub of all power and movements upon which every thing depends; that characteristic, capability, or location from which enemy and friendly forces derive their freedom of action, physical strength, or the will to fight."⁵ The center of gravity would

therefore be that enemy strength or capability that he will use to obtain his strategic objectives, without which, the enemy will capitulate. Clausewitz's discussion on the center of gravity goes on to say that power is derived from the enemy's army, geographic center of government/society/administration (the capitol), or principle ally.⁶ Joint Pub 3-0 says that the ``strategic center of gravity might include a military force, an alliance, national will or public support, a set of critical capabilities or functions, or the national strategy itself.''⁷ With these guidelines in mind, let us look at a four step process to determine the center of gravity.

1. Identify the national objective(s). That is both friendly strategic objectives and that of the enemy. Lt Col Lawrence L. Izzo concludes in his article ``The Center of Gravity is Not an Achilles Heel'' that the planner must determine what the enemy is trying to do because he will surely use his center of gravity to obtain it. ``His center of gravity is the essence of his combat power which will enable him to fulfill that goal. Thus the aim and the combat power allocated to achieve that aim are intimately linked.''⁸ Take out the enemy's ability to achieve his objectives and he will be forced to give up the fight. National objectives are also important, especially in a limited fight. If the enemy's center of gravity is an alliance, political considerations may preclude its destruction (China in the Korean War). Another example may be that friendly forces cannot completely destroy an enemy nation's government as someone is needed with which to negotiate a peace.

2. What will the enemy use to achieve his objectives? If the enemy is using or plans to use military force to achieve his objectives, then destroying that army/air force/navy will force his capitulation. This

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is usually the case in a conventional war and was the case in the Gulf War where selection and destruction of the Iraqi Republican Guard as the center of gravity ended the conflict. In an unconventional war, the army may well be dispersed and not concentrated into any one force. In this case, the will of the people or outside support (allies and suppliers) may be the center of gravity.

3. Where does the enemy's power originate? This is the point where the planner can begin to identify components of the enemy's power as they support the center of gravity. I tend to agree with Lt Col Izzo here when he says that these characteristics of power attacked singularly may weaken the center of gravity, but will not cause enemy defeat.⁹ These are the "critical factors" that Professor Milan Vego speaks, of which the center of gravity is the most crucial.¹⁰ These critical strengths may be infrastructure, command and control, air defense net, leader, industry, or one of the armed forces. However, I disagree with the Joint Pub 3-0 definition of center of gravity and Col John Warden's centers of gravity in The Air Campaign.¹¹ These critical factors are all on the periphery and the destruction of any one of these will not cause immediate withdrawal, but they may set the stage. Some examples may help to illustrate. In the 1973 Israeli-Egyptian War, Israel correctly identified the Egyptian army as the center of gravity. However, only by destroying the critical strength of the air defense network could they hope to "get at" the army.¹² In Desert Storm, in order to prepare for the Coalition Army's attack on the Republican Guard, coalition air power objectives in the first phase of the war were:¹³

Destroy/neutralize air defense command and control

Destroy nuclear, biological and chemical storage and production capability

Render ineffective national and military C3 infrastructure

Destroy key electrical grids and oil storage facilities

Deny military resupply capability

Eliminate long-term offensive capability

Disrupt and weaken Republican Guard forces

In this way, coalition forces were identifying critical factors and preparing the battlefield for an attack on the center of gravity. Prior to attacking the critical factors, the planner must identify the enemy's critical vulnerabilities.

4. What are the enemy vulnerabilities and does their destruction detract from the enemy's power? Some call this a set of weaknesses although vulnerabilities is more accurate. It does no good to attack something that does not give the enemy power or contribute to his goals. However, air power cannot attack a center of gravity if it is not accessible or vulnerable. Therefore, as stated previously, if that center of gravity is not accessible to attack, attack the critical factors that are vulnerable. This will help weaken the center of gravity to the point where it is vulnerable or to the point where the enemy must make a cost-benefit determination that the war is not worth continuing. Here the planner must assess his means against the enemy's sources of power. The choices of vulnerabilities are those same critical factors mentioned in the previous paragraph. Using the Desert Storm example again, the Republican Guard was critical but not accessible, however, command and control both supported the Republican Guard and was accessible, so air power was used to attack it. In the

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Battle of Britain, the Germans chose to attack Britain's will to fight by bombing London because it was accessible, but it was not a critical factor and did not contribute to Britain's defeat.¹⁴ In the same war, the Allied strategic bombing campaign hit Germany's industry, certainly not the center of gravity, but the attacks contributed to weakening the Luftwaffe and the German war making capabilities which, in turn, contributed to the destruction of its army after D-Day.

Once identified, is the Center of Gravity accessible to air power? This question is paramount for the overall planner in his use of air power. We will now narrow down the center of gravity to one of three things for war planners. First is the enemy's armed forces, second is the enemy's will to fight, third is the enemy's external support. This is more along the lines of Clausewitz's explanation. The armed forces include the fielded army, navy, and air force, the will to fight includes the government, leadership, and people, and external support would be allies or suppliers. All other infrastructure, command and control, industry, and armed forces support would then be critical factors. The alliance is not really conducive to an air power attack although it was tried when Saddam Hussain chose to attack the Coalition by attacking Israel with Scuds; this was unsuccessful. The U.S. attempt to attack the supply lines to the Vietcong in Rolling Thunder was a noble goal but air power was not effective in the jungle environment. Attacks on alliances are better suited to the political arm of coercion. Attacks on the will of the people, through bombing of civilians, is hard to predict. History has shown that it usually strengthens the resolve of the enemy (German bombing of Britain, U.S. bombing of Japan). Although some would say US bombing of North Vietnam brought them to the

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negotiating table, the North Vietnamese army was still intact and was pursuing their national objectives of a unified Vietnam. Taking out the enemy leader as Col Warden's article "Employing Air Power in the Twenty-first Century" suggests¹⁵ would be hard to pinpoint with air power and again leaves the army intact. This leaves the armed forces. Although without an army the enemy could probably not hope to achieve their objectives, air power is not suited to utterly destroying the army. First, the armed forces are probably dispersed and dug in enough to render bombing marginally effective. Second, air power is incapable of capturing the army or occupying its territory. So where does air power come in? I contend that it is in attacks on the periphery against those critical factors and perhaps the center of gravity, weakening them to the point of capitulation or preparation for the land war.

ATTACKS ON THE PERIPHERY

Joint Pub 0-1 contends in its definition of the center of gravity that "if it (center of gravity) can be reduced to a singular capability, that capability should be the primary military objective. If complete destruction or neutralization of the center of gravity is not feasible, major inroads against several components thereof may provide the wherewithal for attaining successful termination."¹⁶ These would be attacks on the periphery of the center of gravity in order to weaken it, and air power is very adept for this mission. These attacks on the periphery would be the enablers for future operations. Joint Pub 3-0 agrees with this when it states that air power "against key enemy capabilities can provide advantages for subsequent operations by all components."¹⁷ These key capabilities would be the enemy factors discussed last section.

These critical factors are well identified in Col Warden's "Air Power in the 21st Century" article although he calls them centers of gravity. I will call them critical factors, any one of which may be the strategic center of gravity. The article identifies enemy command, essential production, transportation network, population, and fielded military forces.¹⁸ Some semantics footwork will reveal that these are not very far off our previously mentioned possible centers of gravity. Enemy command could very well be the government who directs policy, the population is the national will, and the fielded military force is the army. The transportation system and essential production are the infrastructure and C2 capabilities that are critical factors on the periphery. The beauty of attacking each of these is that on the way to sequentially attacking the fielded army, destruction of enemy command or breaking of national will may cause early termination of the conflict at best, and at worst significantly weaken the army's ability to fight. Destruction or neutralization of the transportation and essential production facilities will definitely weaken the enemy's war making capability. If none of these peripheral strikes end the war, attacking the fielded army will prepare the battlefield for a ground attack against the true center of gravity. This methodology takes some of the guesswork out of planning the campaign. Air power is the means to accomplish this sequential strategy as it can strike deep and quick hitting all these targets prior to the introduction of ground troops and may, again, lead to early termination. However, if this does not occur, allied ground troops are in a much more advantageous position to destroy the center of gravity.

Prior to air power attacking the strategic center of gravity directly or on its periphery, a major air operation must start with its own sequence and neutralization of the operational center of gravity. This would be the enemy's air defense network. The enabler for all subsequent missions, be they air missions or ground missions, is air superiority. Control of the air allows us to fly over enemy territory with relative impunity and neutralizes the enemy's ability to attack friendly forces from the air. To accomplish this, the air operation must take out the enemy's air-to-air capability, air-to-surface capability, and surface-to-air capability. In his book The Air Campaign, Col Warden identifies the critical factors necessary to attack in order to obtain air superiority (although he call them centers of gravity).¹⁹ These are equipment, logistics, geography, personnel, and command and control. These are all actually characteristics of the larger operational center of gravity known as the Integrated Air Defense System (IADS). The equipment is the aircraft which can be shot down or destroyed on the ground, the warning and guidance radar for surface-to-air missiles, or the actual missiles launchers (Scud sites). The logistics are the fuel and ammunition dumps or their supply networks (transportation). Geography is the air bases themselves either destroyed or caused to be moved so far to the rear as to be useless. The personnel are the pilots, radar operators, and missileers. Finally, command and control is the communications network (both people and electrons) that allow the IADS to coordinate with each other, pass off targets, and warn of impending attacks. Missions flown to gain air superiority in preparation for the major air operation are really part

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of the air operation itself and many of the targets destroyed are denied critical factors that weaken the enemy center of gravity.

With these concepts in mind, we can now build a planning guide for centers of gravity and the air operations that support strategic objectives.

FACTORS AND AIR FORCE MISSIONS

This discussion leads to a seven step approach that identifies the campaign's center of gravity and air power options that contribute to the campaign's strategic objectives. We will list the seven and follow up with some summarizing comments on each.

1. Identify the campaign objectives.
2. Determine the force required for the enemy to achieve his objectives. This is the strategic center of gravity.
3. Determine if air power is applicable.
4. Create conditions for the attack.
5. Attack the center of gravity. If not directly, then weaken it on the periphery.
6. Support other components attack on the center of gravity.
7. Protect your own center of gravity.

As discussed earlier, the first thing a planner must do is determine the objective of the campaign, both for enemy and friendly forces. What is the end-state that the enemy wishes to create and what extent are friendly forces willing to deny that end-state? Alternatively, what is the end-state you desire and are you willing to use all force necessary or must you limit your attack? What is your estimate of acceptable risk?

Once enemy objectives are identified, determine what force the enemy requires to achieve that end. What aspect of power, or critical factor, if denied or destroyed will lead to the enemy's inability to continue the fight? This will usually come in the form of the enemy armed forces, national will and government, or external support. Insure all the critical factors of power that support the enemy's war making capability are identified, but there is only one strategic center of gravity.

Next the planner must determine if air power is an applicable "means" to reach the "ends" of attacking the center of gravity. Is the center of gravity vulnerable to air power? If the center of gravity is national will, do political constraints allow allied forces to bomb population centers or destroy enemy economic and political infrastructure? Will bombing the population cause defeat or stubborn determination? If the center of gravity is the armed forces, are the forces concentrated and out in the open enough where air power can destroy them directly? If it is external support, can theater commanders risk escalation by attacking enemy allies directly? Can air power shut off all supply routes into the country? The ability of any force to attack the center of gravity directly is usually negligible. However, air power is the most versatile force due to its deep strike capability. If air power cannot attack the center of gravity directly, what peripheral supporting critical factors when attacked significantly weaken the center of gravity for follow on attacks? These will usually come in the form of command and control, essential production, transportation network, population, and fielded military forces. Each

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target must be evaluated to insure it supports the objective of destroying the center of gravity.

Fourth, air power must create conditions for the attack. The air operation must first achieve air superiority. Air superiority contributes to friendly freedom of action, degrades the enemy's freedom of action, and lessens risk in the future air/land battle. This is accomplished with offensive counter air to take out the enemy's IADS. The goal here is to render ineffective the enemy's air force and defense network. Destroying the critical factors in the enemy's IADS has the added benefit of weakening the enemy's command and control for later operations and takes away the possibility of the enemy attacking our center of gravity or land/sea forces with their own air power. Critical factors here are equipment, geography, bases, personnel, and C2.

Fifth, attack the strategic center of gravity. The determination must first be made if it is accessible. If so, a cost-benefit analysis must be accomplished to determine if a direct attack is worth the risk. If air power can attack the center of gravity directly, and you identified it correctly, favorable war termination should follow. If air power cannot attack the center of gravity directly, or the cost would be too high, weaken it first by attacking indirectly. Peripheral targets, or critical factors, were discussed under air power applicability in the third step. The air power missions used here are interdiction, strategic bombing, and deep strike (of course, all while maintaining air superiority). The goal here is to soften the battlefield and create the conditions for future attack by either air, land, or sea forces by weakening the enemy on the periphery.

Sixth step is to support the land attack on the center of gravity. This has already started by virtue of air superiority and battlefield preparation. However, now the primary mission is close interdiction and close air support. Air power in this phase is supporting the land battle and the ground troops as they engage and destroy the enemy's armed forces on the ground.

It is important to note that during any of these steps from build-up, to creating conditions for attack, to attacks on the periphery, the enemy may see the futility of his endeavor and capitulate, at which point you have achieved strategic objectives.

The final step, or more correctly, a continuing step is protection of the friendly center of gravity. If the source of enemy power is the friendly objective, then it follows that the enemy may be targeting the source of our power. The campaign planner must allocate the resources and devise a concept to keep the friendly center of gravity safe. This ensures freedom of maneuver and preserves power for mass in later operations. Air power has been contributing to this objective continuously by destroying the enemy's air force, command and control, and keeping the land forces pinned. However, air power is also used in the defensive counter air role protecting the skies over friendly territory along side the army surface-to-air forces. Aircraft maintaining air superiority over friendly lines and bases insure our forces are not attacked and weakened from the sky. Defensive counter air also deprives the enemy ground troops of support from the air. This will all contribute to the maintenance of offensive power in subsequent operations, land, sea, or air.

The campaign planner in modern warfare is faced with many challenges but also with many opportunities. The center of gravity is a concept that has been around, yet ignored for years. The re-emergence of operational art studies have emphasized the identification of center of gravity and its utility in campaign planning. Air power is one of the many tools CINCs have to attack the center of gravity and a particularly effective one due to speed and accessibility. Campaign planners must identify the center of gravity and plan for its destruction and this seven step approach should help to tune CINCs into air power's contribution to strategic objectives.

¹ Carl H. Builder, The Masks of War: American Military Styles in Strategy and Analysis (Baltimore: Johns Hopkins University Press, 1989), p. 68.

² U.S. Air Force Department, Basic Aerospace Doctrine of the United States Air Force, AFM 1-1, Vol I (Washington: 1992), p. 5.

³ Carl Von Clausewitz, On War ed. Michael Howard and Peter Paret (New Jersey: Princeton University Press, 1984), p. 595.

⁴ Ibid., p. 15.

⁵ U.S. Army Department, Operations, FM 100-5 (Washington: 1993), p. G-1.

⁶ Clausewitz, p. 595.

⁷ U.S. Joint Chiefs of Staff, Doctrine for Joint Operations, Joint Pub 3-0 (Washington: 1993), p. III-27.

⁸ Lawrence L. Izzo, "The Center of Gravity is Not an Achilles Heel," Military Review, January 1988, pp. 76-77.

⁹ Ibid., p. 76.

¹⁰ Professor MN Vego, "Fundamentals of Operational Design", in Operational Art: A Book of Readings (Newport RI: Naval War College, 1995), pp. 5-7.

¹¹ John A. Warden, III, The Air Campaign: Planning for Combat (Virginia: Pergamon-Brassy's International Defense Publishers, Inc., 1989), p. 117.

12 Izzo, p. 74.

13 Charles A. Horner, "The Air Campaign", Military Review, September 1995, pp. 21-22.

14 Len Deighton, Fighter: The True Story of the Battle of Britain (New York: Harper Collins Publishers, 1977), p. 314.

15 John A. Warden, III, "Employing Air Power in the Twenty-first Century" in The Future of Air Power in the Aftermath of the Gulf War, ed. Richard H. Shultz, Jr. and Robert L. Pfaltzgraff, Jr. (Alabama: Air University Press, 1992), p. 65.

16 Milan N. Vego, "Glossary of Operational Terms" in Operational Art: A Book of Readings, from Joint Pub 0-1(Deleted), (Newport RI: Naval War College, 1995), p. 3.

17 U.S. Joint Chiefs of Staff, Doctrine for Joint Operations, p. B-1.

18 John A. Warden, III, "Employing Air Power in the Twenty-first Century", p. 65.

19 Warden, The Air Campaign: Planning for Combat, pp. 34-35.

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